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Publication date:
2015

Document Version
Peer reviewed version

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Citation (APA):

Alberti, M., Weber, R., Mancini, M., Fateev, A., & Clausen, S. (2015). *On the accuracy of HITEMP-2010 calculated emissivities of Water Vapor and Carbon Dioxide*. Abstract from 12th International Conference on Energy for a Clean Environment, Lisboa, Portugal.

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On the accuracy of HITEMP-2010 calculated emissivities of Water Vapor and Carbon Dioxide^{*}

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Abstract

Nowadays, spectral Line-by-Line calculations using either HITRAN or HITEMP data bases are frequently used for calculating gas radiation properties like absorption coefficients or emissivities. Such calculations are computationally very expensive because of the vast number of spectral lines and, therefore, these calculations are usually taken as a benchmark to validate less complex models. In order to evaluate the accuracy of these simplified models, the accuracy of the Line-by-Line predictions using HITEMP data base must be known.

We present here some of our recent full spectrum measurements of spectral transmissivities which were done for H₂O-CO₂-N₂ mixtures for temperatures up to 1770K. Using these measured data it is possible to compare the Line-by-Line calculation using HITEMP-2010 on the basis of total (spectrally averaged) emissivity. At high pressures, also a proper lineshape treatment is essential for the accuracy of the Line-by-Line model. Spectral measurements that span the spectral range of at least one whole absorption band are hardly available in literature. Therefore, we compare the standard model with more advanced models which take the line-mixing effects into account. However, we show that also the standard model can be adjusted to yield reliable results.

Keywords: Line-By-Line, HITEMP-2010

^{*} See also M. Alberti, R. Weber, M. Mancini, A. Fateev, and S. Clausen, On the accuracy of HITEMP-2010 calculated emissivities of Water Vapor and Carbon Dioxide, 10th International Conference on Industrial Furnaces and Boilers (INFUB-10), Porto, 2015

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